REMARKS

Claims 48-98 are pending for further examination. Claims 48, 52, 57, 60, 65, 66, 68, 72, 76, 77, 81-83, 87-88, 93 and 98 are currently amended.

35 U.S.C. § 112 Rejections

I. § 112, ¶ 1 Rejection

The Office Action asserts that the limitation "substantially the same composition and thickness" fails to satisfy § 112, ¶ 1 "because the word 'substantially' is never used in the originally filed disclosure to describe any part of the invention." (Final Office Action mailed September 19, 2006, p. 4). Applicant respectfully submits that the Examiner has misinterpreted the requirements of § 112, ¶ 1. It is well-established that lack of literal support in the specification for claim language is not enough to support a rejection under § 112 ¶ 1. *See, e.g., Eiselstein v.* Frank, 52 F.3d 1035, 1039 (Fed. Cir. 1995); *Kao Corp. v. Unilever U.S., Inc.*, 441 F.3d 963, 968 (Fed. Cir. 2006). As the MPEP states, "the subject matter of the claim need not be described literally (i.e., using the same terms or *in haec verba*) in order for the disclosure to satisfy the description requirement." MPEP § 2163.02.

Instead, the appropriate inquiry under § 112, ¶ 1 is whether the specification "describe[s] an invention in sufficient detail that one skilled in the art can clearly conclude that the inventor invented what is claimed." *Kao Corp.*, 441 F.3d at 967-968. "If a person of ordinary skill in the art would have understood the inventor to be in possession of the claimed at the time of filing, even if every nuance of the claims is not explicitly described in the specification, the adequate written description requirement is met." *In re Alton*, 76 F.3d 1168, 1175 (Fed. Cir. 1996).

Moreover, where, as here, an applicant files a declaration explaining why those skilled in the art would find support in the specification for the claimed subject matter, the examiner cannot dismiss the declaration without "articulating adequate reasons to rebut" the declaration *Id.* at 1176; *see also* MPEP § 716.01(B) ("[T]he examiner must specifically explain why [the

declaration] is insufficient. General statements . . . without an explanation supporting [their] findings are insufficient.").

As Applicant previously explained, although the deposited semiconductor layers can generally be characterized as having "the same" composition and thickness, a person of ordinary skill in the art would understand that the deposition process of the type described in this Application inherently leaves small variations in the thickness and composition of the deposited layers, resulting in layers that are "substantially the same" in thickness and composition. Thus, out of an abundance of caution and in the interest of technical accuracy, Applicant amended the claims to recite the phrase "substantially the same" and submitted a declaration under 37 C.F.R. §1.132 demonstrating why the phrase more accurately covers the compound semiconductor layer and is supported by the specification as would be understood by those skilled in the art. (*See* Applicant's § 1.132 Declaration, p. 3) In view of the declaration, it was incumbent upon the Examiner to articulate adequate reasons for dismissing the evidence set forth in the declaration. *Kao Corp.*, 441 at 967-968 (Fed. Cir. 2006); MPEP §716.01(B). The Office action, however, did not articulate any reasons for dismissing the declaration except that the word "substantially" is not literally used in the specification to describe the claimed invention. This reason alone is not sufficient to support a rejection under § 112 ¶ 2. *See Eiselstein*, 52 F.3d at 1039; *Kao Corp.*, 441 F.3d at 968. Absent adequate reasons for dismissing Applicant's declaration, the Examiner's rejections under § 112, ¶ 1 are in error. *In re Alton*, 76 F.3d at 1176.

The Office Action also rejected claim 67 under § 112, ¶ 1. Claim 67 recites in pertinent part that the "bottom cell" is "fabricated at least in part with GaAs." The Office Action asserts that "the range 'as [sic] least in part' for the GaAs fabrication is not supported by the specification[.]" (Final Office Action, p. 3) Applicant respectfully disagrees. The specification explicitly describes an embodiment of the claimed invention with a bottom cell 604 containing layers other than gallium arsenide, including base and substrate layers comprised of germanium (Ge). (*See* Specification of the '414 patent, col. 8, ll. 65-67). Thus, the specification provides ample support for the limitation of a "bottom cell" that is "fabricated at least in part with GaAs."

Based on the foregoing reasons, Applicant respectfully requests withdrawal of the rejections under § 112, ¶ 1.

II. § 112, ¶ 2 Rejection

The Office Action asserts that the phrase "substantially the same thickness and composition" is indefinite under § 112, ¶ 2 because "it is not clear what is to be encompassed by [this] term[.]" (Final Office Action, p. 6) The Office Action further asserts that "the word 'substantially' introduces a 'fudge factor' that opens up whatever it is modifying to interpretation." (*Id.*, p. 4) The Office Action also rejects the arguments raised in Applicant's § 1.132 declaration "because it is not clear how close to having the same thickness the corresponding layers must have in order to be considered to have 'substantially the same thickness.'" (*Id.*, p. 6) Applicant respectfully disagrees with the Examiner's conclusions. As indicated in Applicant's response and declaration, the term "substantially the same thickness" corresponds to normal variations of up to two to three percent in composition and in thickness of a compound semiconductor layer over the surface of the wafer. (*See* Applicant's § 1.132 Declaration, p. 2) Contrary to the remarks of the Examiner, the specified normal range of up to two to three percent variations makes clear "how close to having the same thickness the corresponding layer must be" and falls well within manufacturing specifications for actual commercial products. (*See id.*)

To the extent the Examiner's rejection is based on a perception that the term "substantially" bears some imprecision, Applicant respectfully submits that § 112, ¶ 2 does not impose such a high threshold for claim definiteness. "That some claim language may not be precise . . . does not automatically render a claim invalid." *Seattle Box Co. v. Industrial Crating & Packing*, 731 F.2d 818, 826 (Fed.Cir.1984). The MPEP instructs examiners in a similar vein:

> When the examiner is satisfied that patentable subject matter is disclosed, and it is apparent to the examiner that the claims are directed to such patentable subject matter, he or she should allow claims which define the patentable subject matter with a reasonable degree of particularity and distinctness. Some latitude in the

> manner of expression and the aptness of terms should be permitted even though the claim language is not as precise as the examiner might desire.

MPEP § 2173.02. Although claims that are "insolubly ambiguous" or "not amendable to construction" are indefinite under § 112, ¶ 2, *Datamize, LLC v. Plumtree Software, Inc.*, 417 F.3d 1342, 1347 (Fed. Cir. 2006), where, as here, "the term 'substantially' serves reasonably to describe the subject matter so that its scope would be understood by persons in the field of the invention, . . . it is not indefinite." *Verve, LLC v. Crane Cams, Inc.*, 311 F.3d at 1120.

Applicant's arguments are supported by the numerous Federal Circuit decisions approving the use of the term "substantially" under § 112, ¶ 2. *See, e.g., Verve*, 311 F.3d 1116, 1119-20 (Fed.Cir. 2002); *Ecolab Inc. v. Envirochem, Inc.*, 264 F.3d 1358, 1367 (Fed.Cir.2001); *Howmedica Osteonics Corp. v. Tranquil Prospects, Ltd.*, 401 F.3d 1367, 1373 (Fed. Cir. 2005); *LNP Engineering Plastics, Inc. v. Miller Waste Mills, Inc.*, 275 F.3d 1347, 1356 (Fed. Cir. 2001); *Andrew Corp. v. Gabriel Electronics, Inc.*, 847 F.2d 819, 821 (Fed. Cir. 1988); *Seattle Box Co., Inc.*, 731 F.2d at 826; *Kinzenbaw v. Case LLC*, 179 Fed.Appx. 20, 30 (Fed. Cir. 2006); *see also* MPEP 2173.05(b).[1] The Federal Circuit also has upheld the definiteness of claim terms that closely resemble "substantially the same," including "substantially equal," "substantially equal to" and "substantially uniform." *See Andrew Corp.*, 847 F.2d at 821 ("substantially equal"); *Seattle Box Co., Inc.*, 731 F.2d at 826 ("substantially equal to"); *Ecolab Inc.*, 264 F.3d at 1367 ("substantially uniform").

For the foregoing reasons, Applicant respectfully requests withdrawal of the rejections under § 112, ¶ 2.

[1] The Federal Circuit, furthermore, has also found definite the term "substantially" even though it did not appear in the specification. *See Ecolab, Inc.*, 264 F.3d at 1367; *LNP Engineering Plastics, Inc.*, 275 F.3d at 1355.

35 U.S.C. § 102-103 Rejections

Claims 48-66, 68-70, 72, 73-78, 80, 84-90 and 92-98 were rejected as anticipated by Taylor (GB 2346010A).

Claims 48-98 were rejected as unpatentable over Taylor in view of Martin et al. ("Evaluation of multijunction solar cell performance in radiation environments, Conference Record of the 28th Photovoltaic Specialists Conference, pgs. 1102-1105, Sept. 15-22, 2000) and Lillington et al. (U.S. Patent No. 5,853,497).

Claims 65-92 were rejected as anticipated by Ho et al. (WO 99/62125).

Claims 60-98 were rejected as unpatentable over Ho.

In view of the above amendments and the following remarks, Applicant respectfully requests withdrawal of the rejections.

Independent claims 48 and 52 have been amended to recite that a means for passing current when a multijunction solar cell is shaded is on the "*same* substrate" as the multijunction solar cell and that the means for passing current is "electrically connected in parallel with the multijunction solar cell." Support for these features may be found in the specification in the examples of FIG. 1 and FIGS. 2B-2C. In the example of FIG. 1, a multijunction solar cell 105 is formed on a Ge substrate 104. A diode 106 formed on the *same* Ge substrate 104 is electrically connected in parallel with the multijunction solar cell 105 and provides a pathway 202 (*see* FIG. 2B) for passing current when the multijunction solar cell 105 is shaded (*see* para. [0027], [0029] of the published application). Electrically connecting a bypass diode in parallel to a multijunction solar cell on the *same* substrate can lead to a reduction of interconnection problems that occur when connecting the bypass diode to a multijunction solar cell on a *separate* substrate. As a result, in some implementations, solar cell array fabrication may be simplified and improved.

In contrast, the Taylor reference does not disclose or suggest a means for passing current that is electrically connected in *parallel* to a multijunction solar cell on the "*same* substrate." Although the Taylor reference shows a protection diode 11 formed on the same substrate as a

tandem solar cell (*e.g.*, top solar cell 2, tunnel diode 8 and base solar cell 5), the protection diode 11 and the associated tandem solar cell are not electrically connected in parallel. Instead, the Taylor reference discloses that the protection diode 11 and tandem solar cell are incorporated into an array (*see* pg. 5, line 17-18) and that the protection diode 11 is connected to a tandem solar cell of an "adjacent device" in the array (*see* contacts P1, B1 respectively connected to contacts B2, C2 in FIG. 4a; pg. 6, lines 16-22). As FIG. 4a clearly shows, the tandem solar cell of the adjacent device is on a *separate* substrate from the protection diode to which it is connected. Therefore, the Taylor reference does not disclose electrically connecting in parallel a means for passing current and a multijunction solar cell on the "same substrate" as recited in present claims 48 and 52. Furthermore, there is no suggestion in the Taylor reference to connect the protection diode to the tandem solar cell on the same substrate.

The Marvin et al. reference discloses a GaInP/GaAs two-junction and GaInP/GaAs/Ge three-junction solar cell but does not disclose or suggest electrically connecting in parallel a means for passing current on the same substrate as the two-junction or three-junction solar cells.

The Lillington et al. patent discloses a solar cell that includes GaInP, GaAs, GaInAsP and GaInAs layers, but does not disclose or suggest connecting that solar cell to a means for passing current on the "same substrate."

At least for the foregoing reasons, claims 48 and 52 should be allowed.

Claims 49-51 depend from claim 48 and claims 53-56 depend from claim 52 and should be allowed for at least the same reasons as claims 48 and 52.

Independent claim 57 recites some features that are similar to those recited in claims 48 and 52. For example, claim 57 recites an integrated semiconductor device that includes a bypass diode for passing current on the "same" substrate as a multijunction solar cell, in which the bypass diode is directly electrically connected to a base and a top cell of the multijunction solar cell. In contrast, the Taylor reference discloses connecting a protection diode P1 to a top cell C2 and base B2 of an "adjacent" device on a *separate* substrate (*see* FIG. 4a; pg. 6, lines 16-22) as part of an array of solar cell devices. The Taylor reference does not disclose or suggest that the

protection diode 11 is connected to a top cell and base of a multijunction solar cell on the "same substrate" as the protection diode 11. Furthermore, the Lillington et al. patent and Marvin et al. reference do not disclose or suggest connecting a bypass diode to a base and top cell of a multijunction solar cell on the "same substrate."

At least for the foregoing reasons, claim 57 should be allowed.

Claims 58-59 depend from claim 57 and should be allowed for at least the same reasons as claim 57.

Independent claim 60 has been amended to recite that a deposited metal layer, which connects a multijunction solar cell to a means for passing current, is "disposed on sides of layers between the base of the first solar cell and [a] terminal in the means for passing current" and is "entirely on a surface of said means for passing current." An example of that feature is shown in FIG. 1 of the present application. In that example, a metal layer 107 is entirely disposed on the sides and top of a first GaAs lateral conduction layer 113 and Ge cell 104 as well as on the sides of a GaAs buffer layer, an InGaP etch stop layer and a second GaAs lateral conduction layer. The metal layer 107 electrically shorts the GaAs buffer layer, InGaP etch stop layer, and Ge junction in the cell 104 (*see* para. [0027-0029] in the published application). Shorting the Ge junction reduces the voltage required to pass current through the path of the bypass diode 202 and can, in some implementations, provide a more efficient solar cell device.

In contrast, neither the Taylor reference nor the Ho reference discloses or suggests a metal layer disposed on the "sides of layers between the base of [a] first solar cell and [a] terminal" in a means for passing current or a metal layer "entirely on a surface" of a means for passing current.

Instead, the Taylor reference discloses electrical contacts 15 bonded to a tandem solar cell and protection diode 11 (*see* pg. 6, lines 16-17), but does not disclose or suggest, in any way, that those electrical contacts are disposed on the "sides of layers" between a base of a first solar cell and a terminal in the protection diode 11 or that they are "*entirely* on a surface" of the protection diode 11.

The Ho reference discloses a C-clamp 1442, which the Office action alleges corresponds to the claimed metal layer, that connects a front metal contact 1440 of a bypass diode 1410 to a back metal contact 1430 (*see* pg. 8, lines 19-23). The Ho reference does not disclose or suggest, however, that the C-clamp is "entirely on a surface" of bypass diode 1410 or that it is disposed on "sides of layers" between a base of a first solar cell and a terminal in a means for passing current when the solar cell is shaded. FIG. 14B clearly shows that only a portion of the C-clamp is in contact with the front contact 1440 and the back contact 1430. There is no disclosure or suggestion in the Ho reference to connect the entire C-clamp to the sides of any layers between the base of a first solar cell and a terminal in the bypass diode or that it is even possible to dispose the C-clamp on the sides of those layers. Furthermore, even if the C-clamp could be disposed on layers between the base of a first solar cell and a terminal in the bypass diode, the solar cell would cease to function correctly because the bypass diode 1410 would be shorted.

Similarly, the integral connector 1436 of the Ho patent is neither disposed on the "sides of layers" between a base of a first solar cell and a terminal in a means for passing current nor is the connector 1436 "entirely on a surface" of a means for passing current when a multijunction solar cell is shaded. Instead, portions of the integral connector 1436 are on tunnel diode 1408, insulator 1434 and GaAs cap layer 1428, none of which correspond to a means for passing current when a multijunction solar cell is shaded.

Furthermore, neither the Marvin et al. reference nor the Lillington et al. patent discloses or suggests disposing a metal layer on the "sides of layers between the base of [a] first solar cell and [a] terminal" in a means for passing current when a multijunction solar cell is shaded or including a metal layer that is "entirely on a surface" of a means for passing current when a multijunction solar cell is shaded. Indeed, neither the Marving et al. reference nor the Lillington et al. patent discloses or suggests a means for passing current when the solar cell is shaded.

At least for these reasons, claim 60 should be allowed.

Claims 61-64 depend from claim 60 and should be allowed for at least the same reasons as claim 60.

Independent claim 65 has been amended to recite that a metal layer "entirely on a surface" of a bypass diode is disposed in a space between a first region having a multijunction solar cell and second region having the bypass diode. Claim 65 further recites that the metal layer "electrically shorts a plurality of layers of the second region between the multijunction solar cell and the bypass diode." Support for those features may be found in paragraphs [0027-0029] of the published application. As discussed above in connection with claim 60, shorting the layers between a multijunction solar cell and a bypass diode may reduce the voltage required to pass current through the path of the bypass diode and can, in some implementations, provide a more efficient solar cell device.

In contrast, neither the Taylor reference nor the Ho reference discloses or suggests a metal layer, disposed in a space between a first and second region, that "electrically shorts a plurality of layers of the second region between [a] multijunction solar cell and [a] bypass diode."

Although the Taylor reference discloses electrical contacts 15 bonded to a tandem solar cell and protection diode 11 (*see* pg. 6, lines 16-17), the contacts 15 do not "electrically short" any layers of the protection diode 11 or the tandem solar cell. Instead, the contacts 15 are used to connect tandem solar cells and protection diodes in series (pg. 6, line 18). Furthermore, FIG. 4a clearly shows that the contacts 15 are not "*entirely* on a surface of a bypass diode." Instead, just a portion of the contacts are on a surface of the bypass diode.

Likewise, although the Ho reference discloses a short integral connector 1436 disposed in a trough between solar cell 1400 and bypass diode 1410 (*see* FIG. 14B; pg. 8, lines 18-19), the connector 1436 does not "electrically short" a plurality of layers of the bypass diode 1410. Rather, the integral connector 1436 is used to connect the top of solar cell 1400 to tunnel diode 1408 such that the solar cell 1400 is in an anti-parallel configuration with the bypass diode 1410 (pg. 6, lines16-24).

Additionally, the C-clamp 1442 of the Ho reference does not "electrically short" layers between a multijunction solar cell and a bypass diode nor is the C-clamp 1442 "disposed in a space between a first region and second region" as recited in present claim 65. Instead, the C-

clamp connects the front metal contact 1440 of bypass diode 1410 to a back metal contact 1430. There is no disclosure or suggestion in the Ho reference that the C-clamp connection electrically shorts *any* layers between the bypass diode 1410 and solar cell 1400. Furthermore, FIG. 14B of the Ho reference clearly shows that the C-clamp 1442 is located *outside* of the trough separating solar cell 1400 and bypass diode 1410.

In addition, neither the Marvin et al. reference nor the Lillington et al. patent discloses or suggests a metal layer, disposed in a space between a first and second region, that "electrically shorts a plurality of layers of the second region between [a] multijunction solar cell base and [a] bypass diode."

At least for the foregoing reasons, claim 65 should be allowed.

Claims 66-67 depend from claim 65 and should be allowed for at least the same reasons as claim 65.

Independent claim 68 has been amended to recite a solar cell semiconductor device that includes a "first discontinuous lateral conduction layer *directly*" on a substrate in which the lateral conduction layer includes a first portion in a bypass diode that is adapted to electrically contact a metal layer "disposed on a side of the discontinuous lateral conduction layer" and a second portion in the bypass diode that is "laterally spaced away from the first portion" and adapted to electrically contact an active region of a bypass diode.

An example of those features are shown in FIG. 1 in which a GaAs lateral conduction layer formed *directly* on a Ge substrate 104 is separated into a two discontinuous portions (one in the junction stack 105 and one in the diode 106). The discontinuous portion of the GaAs lateral conduction layer in the diode 106 makes a lateral electrical connection to a metal layer 107 disposed on the side of the GaAs conduction layer as well as an electrical connection to a InGaP Schottky contact 111 of the diode 106.

In contrast, neither the Taylor reference nor the Ho reference discloses or suggests a lateral conduction layer as recited in present claim 68.

As shown in FIG. 1C of the Taylor reference, a bottom cell base 7 on the substrate 1 may be separated into two portions by a trench etch (pg. 5, lines 11-14). However, the portion of bottom cell base 7 in protection diode 11 does not "electrically contact a metal layer" disposed on a side of bottom cell base 7. Indeed, there is no suggestion or disclosure in the Taylor reference that the portion of bottom cell base 7 in protection diode 11 contacts any metal layer.

The Ho reference discloses a Ge emitter layer 1404 (*see* FIG. 14B) on Ge substrate 1402, but does not disclose or suggest that the emitter layer 1404 is "discontinuous" or that it "electrically contact[s] a metal layer" disposed on its side. Instead, FIG. 14B clearly shows that the emitter layer 1404 is formed *continuously* on the surface of Ge substrate. Furthermore, there is no disclosure or suggestion of electrically connecting the emitter layer 1404 to a metal disposed on its side.

In addition, neither the Marvin et al. reference nor the Lillington et al. patent discloses or suggests a "first discontinuous lateral conduction layer directly" on a substrate in which the lateral conduction layer includes a first portion in a bypass diode that is adapted to electrically contact a metal layer "disposed on a side of the discontinuous lateral conduction layer" and a second portion in a bypass diode that is "laterally spaced away from the first portion" and adapted to electrically contact an active region of the bypass diode.

At least for the foregoing reasons, claim 68 should be allowed.

Claims 69-76 depend from claim 68 and should be allowed for at least the same reasons as claim 68.

Currently amended independent claim 77 recites, in part, a lateral conduction layer deposited on a substrate in which the lateral conduction layer includes a second portion, physically separated from a first portion, that includes a first region directly and electrically contacting a first InGaP layer of a bypass diode and a second region "laterally spaced apart from the first region" that directly and electrically contacts a metal layer.

An example of those features is shown in FIG. 1. In that example, lateral conduction layer 113 includes a first portion in the GaAs buffer 103 and a second portion in the diode 106.

The second portion directly and electrically connects to an InGaP layer located above the lateral conduction layer 113 and also directly and electrically connects to a metal layer 107 at a region laterally spaced apart from where the layer 113 connects to the InGaP layer. The metal layer 107 serves to short the Ge substrate/solar cell 104 (*see* para. [0039-0042]).

The Taylor reference and Ho reference do not, however, disclose or suggest a lateral conduction layer that includes a first region directly and electrically contacting a first InGaP layer of a bypass diode and a second region "laterally spaced apart from the first region" that directly and electrically contacts a metal layer.

Although the Taylor reference discloses tunnel diode layers 9a, 10a and protection diode layers 11 separated respectively from tunnel diode 8 and solar cell 5, there is no disclosure or suggestion that the tunnel diode layers 9a, 10a or protection layers 11 "directly and electrically contact an InGaP layer" or that they "directly and electrically contact a metal layer" at a location "laterally spaced apart" from an InGaP contact region.

Likewise, although the Ho reference discloses tunnel diode layers 1418, 1420 and a bypass diode formed from GaAs layers 1414, 1412, there is no disclosure or suggestion in the Ho reference that those layers "directly and electrically contact an InGaP layer" or that they "directly and electrically contact a metal layer" at a location "laterally spaced apart" from an InGaP contact region. Indeed, the only layer in the bypass diode 1410 that contacts a metal is tunnel diode layer 1420 which connects to front metal 1440. However, front metal 1440 covers the entire top surface of tunnel diode layer 1420 and is not "laterally spaced apart" from an InGaP contact region.

Furthermore, neither the Marvin et al. reference nor the Lillington et al. patent discloses or suggests including a second portion, physically separated from a first portion, that includes a first region directly and electrically contacting a first InGaP layer of a bypass diode and a second region "laterally spaced apart from the first region" that directly and electrically contacts a metal layer as recited in present claim 77.

At least for the foregoing reasons, claim 77 should be allowed.

Claims 78-80 and 82-87 depend from claim 77 and should be allowed for at least the same reasons as claim 77.

Independent claim 88 has been amended to recite that a sequence of layers forming a bypass diode includes a "highly conductive discontinuous lateral semiconductor conduction layer" deposited on a substrate that includes a "first portion" in the bypass diode for making direct electrical contact with a first active layer and a "second portion laterally spaced away from the first portion" that forms a contact region to allow the bypass diode to be electrically connected to a multijunction solar cell. Support for these features is shown in the example of FIG. 1 and in paragraphs [0037-0042] of the published application. In the example of FIG. 1, a lateral conduction layer 113, formed discontinuously in a bypass diode 106 and a multijunction solar cell 105, is in "direct electrical contact" with an InGaP layer in the bypass diode 106. Furthermore, the conduction layer 113 also has a "shelf" region laterally spaced away from the InGaP connection region on which a metal 107 is formed to connect the bypass diode to a multijunction solar cell 105 (para. [0037]).

Neither the Taylor reference nor the Ho reference discloses or suggests a "highly conductive discontinuous lateral conduction layer" in a bypass diode that includes a first portion directly electrically contacting an active layer of the bypass diode and a second portion, "laterally spaced away from the first portion," that is adapted to form a contact region which electrically connects the bypass diode to a multijunction solar cell.

Although the Taylor reference discloses a bottom cell base 7 that contacts bottom cell emitter 6 (*see* FIG. 1c), there is no disclosure or suggestion that the bottom cell base 7 also includes a portion "*laterally spaced away from*" the bottom cell emitter 6 connection, which forms a contact region electrically connecting the protection diode 11 to a multijunction solar cell. In addition, although the Ho reference discloses several layers (*e.g.*, 1420, 1418, 1416, 1414, 1412) in a bypass diode 1410 which are separated from corresponding layers in a solar cell 1400, the Ho reference does not disclose or suggest that any of those layers include a portion

adapted to form a contact region that is "*laterally spaced away from*" an active layer connection region.

Furthermore, neither the Marvin et al. reference nor the Lillington et al. patent discloses or suggests a portion of a "highly conductive discontinuous lateral conduction layer" that is adapted to form a contact region "*laterally spaced away from*" an active layer connection region of the lateral conduction layer.

At least for the foregoing reasons, claim 88 should be allowed.

Claims 89-92 depend from claim 88 and should be allowed for at least the same reasons as claim 88.

Independent claim 93 has been amended to recite a solar cell semiconductor device that includes a metal layer deposited on a portion of a substrate and over a portion of a second region for "electrically shorting semiconductor layers between the substrate and a lateral conduction semiconductor layer" of the second region. An example of a metal layer that electrically shorts semiconductor layers between a substrate and a lateral conduction layer is shown as layer 107 in FIG. 1. The layer 107 is connected to both lateral conduction layer 113 and Ge substrate 104, effectively shorting the semiconductor layers in between. As discussed above, this reduces the voltage necessary to pass current through the diode 106 under reverse bias conditions and may, in some implementations, improve device efficiency.

In contrast, neither the Taylor reference nor the Ho reference discloses or suggests a metal layer that electrically shorts semiconductor layers "between [a] substrate and a lateral conduction semiconductor layer." Although both references disclose contacts (electrical contacts 15 in the Taylor reference; integral connector 1436, front and back contact 1438, 1430 and C-clamp in the Ho reference), those contacts do not "electrically *short*" any *semiconductor layers* between a substrate and a lateral conduction layer. Instead, the electrical contacts 15 of the Taylor reference merely provide a low resistance path from the protection diode 11 to a tandem solar cell in an adjacent device. The semiconductor layers of the solar cell and protection diode of the Taylor reference, however, are not "shorted" since the impedance of the electrical pathway

through those semiconductor layers remains unchanged. Similarly, the contacts of the Ho reference are used to connect the bypass diode 1410 and solar cell 1400 in an "anti-parallel configuration" (*see* pg. 8, lines 21-22) but do not "electrically short" semiconductor layers between the substrate 1402 and a lateral conduction layer.

In addition, neither the Marvin et al. reference nor the Lillington et al. patent discloses or suggests metal layer that electrically shorts semiconductor layers "between [a] substrate and a lateral conduction layer."

At least for the foregoing reasons, claim 93 should be allowed.

Claims 94-98 depend from claim 93 and should be allowed for at least the same reasons as claim 93.

In addition, the dependent claims recite features that makes these claims independently patentable. For example, claims 51 and 56 recite that the bypass diode includes a Schottky junction and claim 83 recites that a Schottky junction is formed with a second InGaP layer. An example of those features is shown in FIG. 1 of the present application in which TiAu contacts 110 are formed on an InGaP layer in diode 106 such that a Schottky junction is established (*see* para. [0035] in the published application). The Schottky junction serves as a diode in series with the electrically shorted Ge junction 104. Since the turn-on voltage of the Schottky diode is relatively small and the Ge junction 104 is shorted, the voltage required to pass current through the bypass diode 106 can be reduced.

In contrast, neither the Taylor reference nor the Ho reference discloses or suggests a Schottky contact in a bypass diode or a Schottky contact formed with an InGaP layer. Furthermore, it would not have made sense for one of ordinary skill in the art to include a Schottky contact with a bypass diode in the Taylor or Ho reference since the formation of that contact would serve to *increase* the voltage required to pass current through the bypass diode.

In addition, neither the Lillington et al. patent nor the Marvin reference disclose or suggest forming a Schottky junction in a bypass diode or with an InGaP layer.

At least for these additional reasons, claims 51, 56 and 83 should be allowed.

Conclusion

In view of the above remarks, all remaining claims are allowable and a notice of allowance should be issued.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

No fee is believed due. However, please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

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